

Passage, survival, and approach patterns of juvenile salmonids at McNary Dam, 2008

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ABSTRACT

We released 2,373 yearling Chinook salmon, 2,928 subyearling Chinook salmon, and 1,971 juvenile steelhead with surgically implanted tags to conduct a second-year evaluation of fish passage and survival with respect to two Temporary Spillway Weirs (TSW) at McNary Dam. In 2008, the TSWs were inserted in spill bays 19 and 20. We investigated behavior, passage, and survival of acoustic-tagged fish among river reaches, spill treatments, passage locations, and diel periods, and compared these results to a 2007 evaluation.

In 2008, we divided the spring study into an early (before May 17th) and late season based on a distinct increase in total spill and project discharge. The TSWs discharged about 4.8–9.5% of the total discharge. Eighteen percent of yearling Chinook salmon and 41% of juvenile steelhead passed into the TSWs. Passage of fish per unit volume of water was 2.0–2.4:1 for yearling Chinook salmon and 3.9–5.9:1 for juvenile steelhead, whereas conventional spill bays passed 1.0–1.2:1 fish per unit volume of water. TSW passage proportions were reduced during the late spring due to high flows (mean total discharge=375 kcfs), high spill (~50% of total project discharge), and lower allocation of flow through the TSWs (~4.8% of total project discharge).

The summer study was divided into an early season (before July 4th) without treatment tests and a late season with tests of 40% versus 60% of total discharge spilled. The TSWs discharged about 5.5–9.2% of the total flow and conventional spill bays discharged about 32–52% of the total flow. Overall, the TSWs passed 17% of subyearling Chinook salmon. During the early summer and the 60% spill treatment the spillway passed 56–59% (SE< 2.1) of subyearlings, but during the 40% spill treatment the spillway passed 33% (SE=2.0). Passage of subyearling Chinook salmon per unit volume of water for the TSWs was 2.0–2.3:1 and for conventional spill bays was 1.2:1. Although periods of high flow and spill contributed to lower TSW passage proportions in 2008, evidence also suggested that moving a TSW from its 2007 location may have contributed to lower passage of subyearling Chinook salmon through the structures.

Periods of higher flow and spill during both the spring and summer were associated with higher fish passage through spill and higher survival through the dam. This was most apparent in summer. In early summer and high flows, both treatment and control releases of fish had higher survival through and below the dam ($S_{\text{dam}} > 0.94$, SE<0.016) compared to late summer and lower flows ($S_{\text{dam}} < 0.90$, SE<0.017). Among the late summer treatment tests, the 60% spill treatment was associated with the higher paired-release survival ($S_{\text{dam}} = 0.96$, SE=0.024) compared to the 40% spill treatment ($S_{\text{dam}} = 0.93$, SE=0.026). In both the spring and summer, we observed inconsistent differences in survival making it difficult to determine the extent to which TSW design, TSW location, and dam operations are influencing survival.